

Title: Number by Number, Which Team Is the Best

Brief Overview:

Using the Internet, students will access information and statistics about professional basketball teams. They will use these data to explore correlations between player characteristics and their performance on the basketball court.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
Students will demonstrate their ability to work cooperatively, to use computer and calculator technology, and to interpret the data presented in table and graphical format.
- **Mathematics as Communication**
Students will be able to communicate their mathematical understanding using a variety of types of graphs. They will be asked to produce written analysis of data, and justify their conclusions.
- **Mathematics as Reasoning**
Students will use the statistics they gathered to justify their conclusions about what player characteristics relate to being a successful NBA player.
- **Mathematical Connections**
Students will be able to connect this unit to geography, language arts, and physical education (sports).
- **Number and Number Relationships**
Students will also be able to show their understanding of the relationships among decimals, fractions and percents. Students will be able to convert feet to inches.
- **Computation and Estimation**
Students will demonstrate their ability to perform basic mathematical computations, to choose an appropriate operation to solve a problem and to determine if the solution is sensible.
- **Patterns/Algebra**
Students will be able to identify a relationship between two sets of data from a graph. They will identify graphs with positive, negative, or zero correlations. Students will also be able to solve basic formulas.
- **Statistics**
Students will demonstrate their ability to collect, organize and display data using appropriate graphs. They will also calculate measures of central tendency. Using their data, students will be able to form logical conclusions and express them in clear language.
- **Probability**
Students will use their data to make predictions about the success of basketball players.

Grade/Level:

Grades 6, 7 or 8

Duration/Length:

Five class periods, or more, depending on use of extensions, depth of analysis, and the ability of your class.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Basic familiarity with the Internet, and the ability to locate web sites when given an URL
- Fractions, decimals, and percents
- Graphing on the coordinate plane

Objectives:

Students will:

- calculate measures of central tendency to compare data.
- graph scatter plots and identify correlations if they occur.
- communicate conclusions and interpretations of graphs in writing.
- locate cities of NBA franchises on a blank map of the United States of America.

Materials/Resources/Printed Materials:

- Access to the Internet
- Graph paper
- Calculators (scientific or graphing preferred)
- Blank maps of the United States, with state outlines
- Basketball terms and abbreviations
- Outline map of the United States
- Worksheets for statistical calculations (4 sheets)
- Directions for use of TI83 graphing calculator for measures of central tendency
- Analytical questions requiring written responses

Development/Procedures:**STEP ONE:**

Assign students to groups of 2 or 3 and randomly assign each group an NBA team.

Review basketball terms on attached list. (#1)

Students will use the Internet to locate a list of all the NBA teams as well as their assigned team's statistics. All required statistics can be found at www.nba.com. Students should produce a hard copy of the list of NBA teams and their locations, as well as their team's individual players' season statistics and team roster.

STEP TWO:

Students will locate each of the NBA teams on the attached outline map (#2) of the United States as closely as possible to the location of the correct city and state.

STEP THREE:

Students will convert the players' heights given in the Internet tables into inches and the ages from dates of birth to years. Students will calculate the mean, median, and mode of the players' heights (in inches), weights, and ages (in years).

Use scientific or graphical calculator, if available.

Students will calculate the total points scored by each player using the formula:

$$2(\text{FGM}) + 3(3\text{PM}) + 1(\text{FTM}) = \text{total points.}$$

For each player, they will calculate average points per minute played and average points per game. (See attached worksheets #3 to enter data and calculate measures of central tendency)

Directions for using the TI-83 are in attachment #4.

STEP FOUR:

Discuss the concepts of positive, negative and zero correlation. Have students predict relationships (if any) between pairs of variables below and have them justify their predictions.

Students will generate and create scatter plots between the following pairs of variables:

- age vs. total points scored
- height vs. total points scored
- player number vs. total points scored
- weight vs. total points scored

They will generate and create bar graphs between the following potential relationships:

- position (Guard, Center, Forward) vs. average height of players at those positions
- position vs. total number of points scored at those positions.

STEP FIVE

Help students to interpret the graphs generated in Step 4 and to assess whether the relationships obtained represent positive, negative or no evident correlation. Advanced students may be able to use graphing calculators to fit lines or other curves to the points. Students will respond in writing to the analytical questions in attachment #5

STEP SIX

Students will pool classroom data on mean heights, ages, average points per minute, total points scored and predict, based on the data, which teams will be most successful, and why. They will then compare their data with team standings published in newspapers, magazines, and the Internet. The students may use their data to predict the outcome of a current game during the NBA season. (NBA season starts in October)

Performance Assessment:

Each student will be required to assemble a packet containing the following materials:

1. Printout of team and player data from Internet
2. Statistics worksheets (attachment #3)
3. U.S. map, with NBA teams located (attachment #2)
4. All graphs listed in Step 4 above
5. Written responses to analytical questions (attachment #5)
6. Team comparison chart generated in Step 6 (attachment #3)

Teacher will assess the quality and completeness of each of the packets. (Using, when appropriate, the attached rubrics.)

Extension/Follow Up:

Students can locate a list of player salaries and use that list to relate salaries to points scored, minutes played and points per minute, as well as to calculate costs in dollars per minute played. They can discover who is the most expensive player in terms of dollars/minute played and who is the “best buy”--the player who costs the least per point scored.

Students can use their data to have a mock draft and create their own teams and play a variation on “fantasy basketball.” Teachers might include a maximum amount of money that each group can “spend” on its team. Students can create their own logo for their new team.

Students can tape a real basketball game, either of their school’s team or of a professional game and collect the statistics and create their own tables.

Using the map, students can determine which geographical areas would benefit from an expansion team and write a letter to the Commissioner of the NBA, explaining why a new team should be placed in that city.

Authors:

Patricia Aanonsen
Benjamin Stoddert Middle School
Prince George’s County, MD

Bonnie Lacey
St. Ignatius School
Prince George’s County, MD

Charlene Pritzker
Burgundy Farm Country Day School
Fairfax County, VA

Attachment #1: A Guide To Basketball Abbreviations

Reading the Statistics

There are two sections to the statistics, averages and totals. Anything with a % is an average for the season. There are 82 regular season games in a season. These statistics do not include playoff games.

G= Games played

GS= Games started

MPG = Minutes played for the whole season

FGM = Field Goals Made (Each shot taken in the NBA inside the three point line is worth 2 points)

FGA = Field Goals Attempted

3PM = 3 point shots Made (All shots taken from behind the three point line. They are worth three points.)

3PA= 3 point shots attempted

FTM = Free Throws Made (Better known as Foul Shots. These players get a free shot from the foul line (which is 15 feet away from the basket) after they have been fouled from a defensive player. Each shot is worth one point.)

FTA = Free Throws Attempted

REBOUND SECTION

OFF = Offensive Rebounds (Rebounds made by a player whose teammate shot the basketball)

DEF= Defensive Rebounds (Rebounds made by a player from the opposing team.)

TOT = Total number of Offensive and Defensive rebounds

OTHER STATISTICS

A = Assist (A pass from a player to his teammate, and that teammate then scores a basket.)

B= Blocks (A block shot)

PLAYER ROSTERS

NUM = The number on the player's jersey

POS= The position that the player plays

G = Guard (The person who dribbles the ball up and shoots from the outside of the basket area. Usually shorter players.)

F = Forward (The person who plays close to the basket. Usually taller players.)

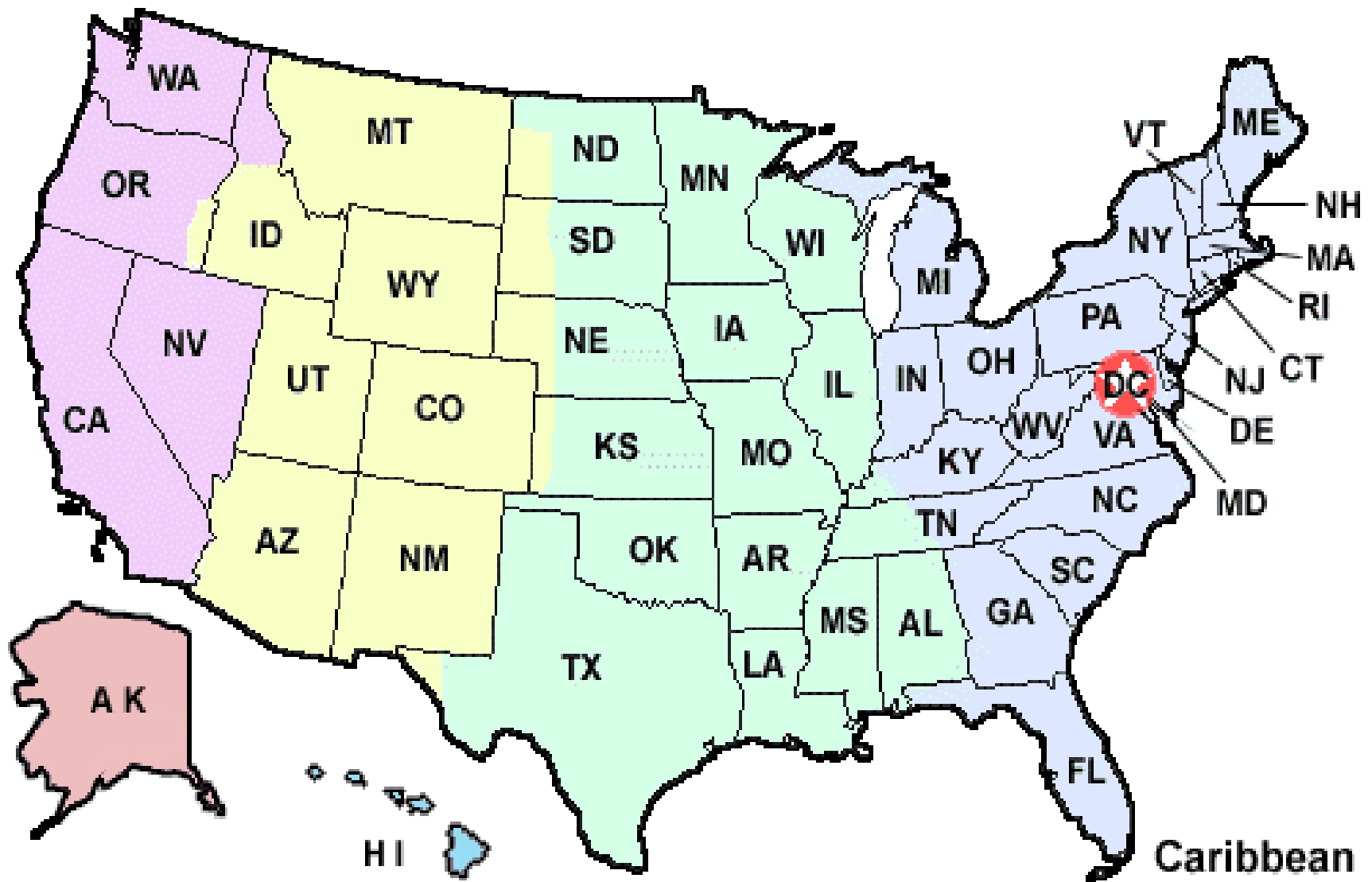
C = Center (The person who is the tallest player on the team. Usually plays near the basket.)

WT = Weight

DOB = Date of Birth

FROM = Colleges the players attended, and the year they graduated from school or left school.

ATTACHMENT #2--Outline Map of the United States



NAME _____

NAME OF	HEIGHT IN	HEIGHT IN		AGE IN	
PLAYER	FEET & INCHES	INCHES	DOB	YEARS	WEIGHT
	TOTALS				
	MEAN				
	MEDIAN				
	MODE				

ATTACHMENT #3B--Calculation of Total Points Scored

NAME _____

FORMULA = 2(FGM) + 3(3PM) + 1 (FTM) = TOTAL PTS

[illegible]

FORMULA #1: AVERAGE POINTS PER MINUTE = $\frac{\text{TOTAL POINTS}}{\text{MINUTES PLAYED}}$

FORMULA #2: AVERAGE POINTS PER GAME PLAYED = $\frac{\text{TOTALS POINTS}}{\text{TOTAL GAMES PLAYED}}$

[illegible]

ATTACHMENT 3D--Pooled Classroom Data

[illegible]

ATTACHMENT #4

INSTRUCTIONS FOR CALCULATING MEASURES OF CENTRAL TENDENCY USING THE TI-83 GRAPHING CALCULATOR

1. To enter your data, turn on the calculator and clear contents of L1 by pressing STAT, then EDIT. Use the arrow key to go up to the label L1, press #CLEAR, then ENTER. Repeat the same procedure for L2 and any other lists you will use.
2. Press STAT then EDIT. Enter your data into L1, pressing ENTER after each entry. If you have additional sets of data, you can enter them into lists L2, L3, etc.
3. Sort your data by pressing STAT, then SortA, then ENTER.. On the next screen, type L1 (or the appropriate list number) after SortA(by pressing 2nd-L1, then enter. You can see that your data has been sorted from smallest to largest by pressing STAT, then Edit, then Enter. You can then easily scan the data to find the MODE(s), if any.
4. To find the MEAN and MEDIAN of your data, press the STAT button, use the arrow key to highlight CALC, choose #1 (1-Var Stats) and press ENTER. On the next screen, type L1 (or the appropriate list number), then ENTER.
5. The first item on the screen, \overline{X} , is the MEAN. Scroll down. The MEDIAN is indicated by Med on the second screen. Copy these data to your worksheet.

INSTRUCTIONS FOR PRODUCING SCATTER PLOTS USING THE TI-83 CALCULATOR

1. Enter the data you wish to compare in lists L1, L2, etc. as in numbers 1 and 2, above.
2. Press the WINDOW button and set minimum and maximum values for your x and y coordinates as appropriate for the data you are plotting.
3. Press the 2ND key followed by y=. Choose 1, followed by ENTER.
4. Choose ON, then select the first graph type (scatter plot).
5. For XList, choose the list (L1, L2, etc.) for your x axis by pressing 2ND key, then L1, L2, etc. For YList, choose the list (L1, L2, etc.) for your y axis.
6. Press the GRAPH button to see the scatter plot.

ATTACHMENT #5

ANALYTICAL QUESTIONS

Answer in complete sentences on a separate sheet of paper.

1. Which of the variables you tested were positively correlated with player success as measured by total points scored? Which of these variables appeared to be the best predictor of success? Do these results make sense? Why or why not?
2. Were there any variables which were not at all correlated with success on the basketball court? Did these results make sense? Why or why not?
3. Were there any variables which were negatively correlated with success? Did these results make sense? Why or why not?
4. Based on your data, what would you look for if you were a team manager trying to find the players most likely to score many points for your team? Why?
5. Should the team manager choose only those players likely to score the most points? Why or why not? What other factors should he/she consider?
6. Do you think team location is related to success of basketball teams? How could you test your hypothesis?
7. Which of your results surprised you? Explain why you were surprised and try to explain why you got the result you did.
8. Suggest other variables which might be more strongly correlated with player success on the basketball court than the ones in this experiment.
9. Can you predict the success of a team based on the statistics of the individual players? Give evidence based on the class data to support your answer.

RUBRIC FOR GRAPHS

FOUR POINTS:

- A) GRAPH HAS A TITLE
- B) Y AND X AXIS ARE CORRECTLY LABELED
- C) X AND Y AXIS HAVE APPROPRIATE CONSISTENT INTERVALS
- D) GRAPHED CORRECTLY

THREE POINTS:

ANY THREE OF THE ABOVE CRITERIA ARE DISPLAYED

TWO POINTS:

ANY TWO OF THE ABOVE CRITERIA ARE DISPLAYED

ONE POINT:

ANY ONE OF THE ABOVE CRITERIA IS DISPLAYED

ZERO POINTS:

GRAPH WAS NOT EVEN ATTEMPTED

RUBRIC FOR WORKSHEETS

FIND A PERCENTAGE OF THE TOTAL CORRECT ANSWERS FOR:

- 1) CONVERTING HEIGHT TO INCHES
- 2) FINDING THE AGE OF THE PLAYERS FROM DOB
- 3) FIND THE MEAN, MEDIAN, AND MODE OF HEIGHTS, AGES, AND WEIGHTS.
- 4) DETERMINING THE NUMBER OF POINTS FROM:
 - A) TOTAL FIELD GOAL POINTS
 - B) TOTAL THREE POINT POINTS
 - C) TOTAL FREE THROW POINTS
 - D) TOTAL PLAYER POINTS
- 5) FINDING THE CORRECT AVERAGE FOR POINTS PER MINUTE AND AVERAGE POINTS PER GAME, FOR EACH PLAYER.

RUBRIC FOR ANALYTICAL QUESTIONS

3 Points = Answer all sections of each question in complete sentence form.
Answer needs to be justified using data from the graphs.
Answer should include creative or original coherent thought.

2 Points = Answer all sections of each question in complete sentence form.
Answer needs to be justified using data from the graphs.

1 Point = Answer all sections of each question in complete sentence form.
or
Answer needs to be justified using data from the graphs.
or
Answer should include creative or original coherent thought.

0 Points = The question was not answered.